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PATENT SPECIFICATION 921,392

DRAWINGS ATTACHED.

Inventor:—HAROLD VINCENT GORT.

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Index at Acceptance:—Class 99(2), A6A, AB(4A:6A:6B1:7D:8:9:12:13), A6(C:F:H).

International Classification:—F06l.

COMPLETE SPECIFICATION.

Improvements in or relating to Soot Blowers for Steam Boilers.

We, DIAMOND POWER SPECIALTY CORPORATION, a Corporation organised and existing under the laws of the State of Ohio, United States of America, of Lancaster, State of Ohio, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to sootblowers used to remove carbon or ash deposits from the heating surfaces (e.g. tubes) of boilers in order to maintain their thermal efficiency.

The process of sootblowing involves directing one or more jets of steam or compressed air to sweep in an arc over the tube bank of a water tube boiler or the tube plate and the interior of the smoke tubes of an Economic type boiler. The process is usually carried out two or three times a day and on each occasion the blower jet or jets may be caused to sweep over its operative arc one or more times according to the surface conditions adjacent the sootblower position. The number of sootblowers required for a given boiler may vary from 1 to 2 in a simple Economic type boiler up to 30 or 40 or more in a large water tube boiler.

Sootblowers may be operated manually (e.g. by a handwheel), by electric motors or compressed air motors and their sequential operation may be manual or automatic, but the present invention is concerned with sootblowers which are operated by motorised means and have automatic sequential control.

The sequential control must be capable of causing the operation of the sootblowers in a predetermined sequence adopted to suit the particular boiler or, if required, cause a selected single sootblower to remain inoperative or to cause a selected single sootblower to operate individually. A full sequential cycle of blowing usually follows the path of the gases through the boiler and sootblowers are placed in positions enabling the gas path to be effectively covered, the blower at each position operating consequently a required number of times before the next blower in sequence comes into operation.

Further there are two basic types of sootblower, one being retractable and the other non-retractable. In the retractable type one complete blowing cycle comprises axial advancement of the nozzle into its blowing position, rotating the nozzle forward and backwards through the blowing arc while supplying steam or air under pressure to the nozzle, cutting off the steam or air supply and retracting the nozzle into a protected position in the boiler wall. In the non-retractable type a complete blowing cycle merely comprises supplying steam or air to the jet tube, rotating the jet tube through its blowing arc and cutting off the steam of air supply.

In order to effect automatic sequential control of a number of sootblowers, a master control box is generally provided and is sited some distance from the boiler or boilers. It will be appreciated that, for a large boiler installation including several boilers each having a number of sootblowers which are required to operate individually according to the positions and sequentially in respect of the boiler as a whole, the size and complexity of the master control box can be considerable.

It is an object of the present invention to provide a sootblower construction having its

own cycle control means associated therewith which enables the master control box to be substantially simplified.

The basic components of the sootblower to which the present invention may be applied are conventional in that, in the case of a retractable type, there is provided an axially movable and rotatable nozzle, electric or compressed air motor means and transmission means to effect the movement and rotation of the nozzle, and valve means for controlling the delivery of steam or compressed air to the nozzle, and that, in the case of the non-retractable type, there is provided a multi-jet jet tube, rotatable but not axially displaceable, motor means and transmission for effecting rotation of the head and steam or compressed air valve means.

The invention consists in a sootblower of the retractable or non-retractable type, for use in a multi-sootblower installation having a common master control box from which the operation of each sootblower is initiated in predetermined sequence, including rotary means, driven in timed relationship with the rotation of the blower nozzle or multi-jet tube, having a plurality of spaced actuating means corresponding in inter-spacing to one or a number of complete blowing cycles of the blower and control means, adapted to be operated by any one of said actuating means, for causing the master control box to terminate the operation of the sootblower and to initiate operation of the next sootblower in sequence.

By providing for the removal of selected ones of the spaced actuating means, the control of the blower operation is effective to cause two or more blowing cycles to take place successively before the next sootblower is brought into operation.

In the accompanying drawings:—

Figure 1 is a sectional side elevation of a sootblower of the retractable type incorporating the present invention;

Figure 2 is a sectional view taken on the line 2—2 of Figure 1;

Figure 3 is an end view of the sootblower shown in Figure 1;

Figure 4 is a sectional elevation of the driving and control mechanism of a sootblower of the non-retractable type; and

Figure 5 is an end view of the control mechanism shown in Figure 4.

In carrying the invention into effect, according to one mode by way of example, a sootblower of the retractable type will be described as provided with sequential operation control means according to the present invention. Since the sootblower itself may be of known conventional design, the structure thereof will not be described in detail and reference will only be made to its main component and those having an operative relationship with the sequential control means.

Referring now to Figures 1 to 3, a generally tubular housing 10, adapted to be mounted on the boiler wall 11, carries an axially displaceable and rotatable nozzle 12 having apertures 13 through which steam jets are delivered. A steam inlet port 14, controlled by valve means (not shown) is provided in the housing 10 and steam is delivered to the jet tube 15, through apertures 16 when the nozzle 12 has advanced to its forward position inside the boiler as shown in Figure 1.

Axial displacement of the nozzle 12 is conveniently accomplished by a lead screw arrangement 18 driven from a rotatable shaft 19, the rotation of which also serves to rotate the nozzle 12 when the latter reaches its advanced position. The rotatable shaft 19 carries a large diameter spur gear wheel 20 driven through spur gears 21, 22 and 23 from a reversible electric motor 24, but provision is made for decoupling the drive from the electric motor 24 and establishing a drive from a hand wheel 56 through a spur gear 57 for manual operation of the blower if required.

The above described components function as follows:—

When the electric motor 24 is switched on e.g. from the master control box (not shown), the spur gear wheel 20 is caused to rotate and advance the nozzle 12 to its projecting position; when the nozzle 12 is fully advanced, further rotation of the spur gear wheel 20 causes the nozzle 12 to rotate in known manner while simultaneously the steam valve (not shown) opens to supply steam to the nozzle 12; when the nozzle has been rotated through its operative arc, the electric motor 24 is reversed and the nozzle 12 is rotated back to its starting position to complete its actual blowing operation, the steam valve shuts and further rotation of the spur gear wheel 20 (in the reversed direction) cause the nozzle 12 to retract, thus completing a full blowing cycle. The reversal of the electric motor 24 in mid-cycle can be effected by any convenient control means, but a preferred form is described hereafter in association with the present invention.

The task of a sootblower in a given position may be to carry out a single blowing cycle at each operation or a number of successive blowing cycles at each operation.

In order to effect reversal of the electric motor 24, there is provided, according to one aspect of the present invention, an endless sprocket chain 25 trained around three sprocket wheels 26, 27 and 28, the sprocket 28 being secured to the shaft 19 of the spur gear wheel 20 and is driven thereby so as to drive the sprocket chain 25 during the axial and rotating movements of the nozzle 12 and the other two sprocket wheels 26 and 27 being free-running. Attached to the sprocket

chain 25 are two projecting pins, rollers or the like 29 and 30 spaced apart a predetermined distance, i.e. a calculated number of chain links to allow for the forward movement of the nozzle 12 plus a calculated number of links representing the rotary movement of the jet tube 15 in traversing its blowing angle.

Between the two pins or the like 29 and 30 on the chain 25, a spring loaded, toggle-action, lever 31 is disposed so as to be engageable by either pin 29 or 30 according to the movement of the sprocket chain 25. Thus when either pin engages the lever 31, the latter is moved until it reaches its over-centre position and springs over to its alternative position as determined by spaced abutments 32. The lever 31 is fixedly mounted on one end of a shaft 33, the other end of which has a further lever 34 fixedly mounted thereon connected by links 35 and 36 to a conventional electric reversing switch 37 which controls the energising of the electric motor 24. By the arrangement, the electric motor 24 is automatically reversed as soon as the projected nozzle 12 completes its rotary traverse over its blowing angle so that the nozzle is counter-rotated and retracted to complete a blowing cycle, when the other pin or the like 29 or 30 on the sprocket chain 25 trips the lever to reverse the electric motor drive once more and start a new blowing cycle (provided current is still being supplied to the motor according to the operation of the master control box and other control means described hereafter).

In order to control the number of blowing cycles carried out successively by each blower (e.g. from one single cycle up to, say, six or more successive cycles), electric switch means are incorporated in each blower so as to cause the electric motor to be de-energised after the required number of blowing cycles have been carried out.

To this end, an electric micro-switch 38 is mounted on the blower structure and is connected through relay means (not shown) in known manner to cause the master control box to de-energise the associated blower motor and energise the next blower in sequence. The micro-switch 38 has an arm 39 which is operated by abutment means, preferably pins or posts 40, on a drum 41 rotatably mounted on the shaft 33. The drum 41 is driven in timed relationship to the blowing cycle movements of the jet tube 12, so that the pins or posts 40 are brought into a position to engage the micro-switch operating arm 39 at the end of each blowing cycle. The pins or posts 40 are removable and equally spaced around the circular periphery of the drum 41, so that if all pins or posts 40 are in situ, the micro-switch 38 will be actuated after each blowing cycle. If alternate pins or posts 40 are removed, the device will permit two successive blowing cycles to take place before the micro-switch 38 is actuated. Similarly if groups of two pins or posts 40 are removed around the series, three-cycle operation will take place, and if, say, only two diametrically placed pins or posts 40 out of a total of twelve are left in situ a six-cycle blowing operation will result.

Thus the operation of a blower will be initiated from the master control box and the blower will proceed to carry out its blowing operation comprising one blowing cycle or a number of successive blowing cycles, according to the arrangement of the pins or posts 40 on the rotary micro-switch-actuating drum 41, at the end of which the actuation of the micro-switch 38 will cause a signal to be sent to the master control box resulting in the transfer of operations to the next successive sootblower.

The drive for the rotary drum 41 in timed relationship to the blowing cycle movements of the nozzle 12 may be achieved by any convenient gearing, chain drive or other transmission. According to a preferred mode, however, the rotary drum 41 is subjected to a step-by-step incremental drive, in which each step is equal to the spacing between adjacent pin or post positions, i.e. to a one blowing cycle spacing. To this end the drive is taken from the movement of the oscillating lever 31 which operates the electric motor reversing switch 37, but since the lever 31 throws first in one direction and then in the other, only its throw in one direction (i.e. when the lever is operated at the end of a blowing cycle) is utilized. This is conveniently effected by means of a ratchet wheel 42, having the same number of teeth as there are pins or posts 40 on the rotary micro-switch actuating drum 41, secured to the lever shaft 33 to oscillate, or semi-rotate, therewith, and pawl means, preferably a diametrically opposed pair of pawls 43, carried by the rotary drum 41. Thus the throw of the lever 31 to effect operation of the reversing switch 37 in the middle of the blowing cycle is ineffective to drive the rotary drum 41, while the reverse throw of the lever 31 causes the effective engagement of the pawls 43 in the ratchet wheel 42 and a one step rotation of the drum 41. In order to restrain movement of the rotary drum 41 during the non-effective throw of the lever 31, a spring loaded ball 44 presses against the periphery of the rotary drum 41 and engages in a recess 45 therein at each pin or post position to provide a series of "click stops".

In carrying out the invention in association with a sootblower of the multi-jet, or non-retractable type, in view of the fact the jet tube rotates uni-directionally, the oscillating lever and reversing switch of the embodiment shown in Figures 1 to 3 is dispensed with. The driving and control mechanism of such a

non-retractable sootblower will now be described with reference to Figures 4 and 5.

As in the previous embodiment, the jet tube (not shown) is driven by the large diameter spur gear wheel 20 through spur gears 21, 22 and 23 from the electric motor 24. A shaft 50, on which the spur gear 20 is mounted, has a small diameter spur gear 51 fixedly mounted thereon which drives a spur gear 52 through other spur gears 53 and 54 to provide a 6 to 1 reduction ratio. The pins or posts 40 are mounted on, and equally spaced around, the face of the spur gear 52 and operate the arm 39 of the micro-switch 38 in the manner already described. Thus, upon one revolution of the spur gear 20 (which provides one blowing cycle), the spur gear 52 revolves one-sixth of a revolution (60°), so that with six pins or posts 40 mounted on the spur gear 52, the micro-switch 38 will be actuated after each blowing cycle which will cause a signal to be sent to the master control box to transfer operation to the next successive sootblower.

As in the previous embodiment, if alternate pins or posts 40 are removed, two successive blowing cycles will take place before the micro-switch 38 is operated and if only two diametrically opposed pins or posts 40 are left in situ, a three-cycle blowing operation will result. Furthermore, it will be readily appreciated that by changing the reduction ratio of the spur gear 52, the number of pins or posts 40 can be varied to increase the number of blowing cycles as required.

The foregoing description is concerned with electrical operation and control, but it is to be understood that analogous compressed air or hydraulic systems may be substituted for the electrical circuiting and components.

WHAT WE CLAIM IS:—

1. A sootblower of the retractable or non-retractable type, for use in a multi-sootblower installation having a common master control box from which the operation of each sootblower is initiated in predetermined sequence, including rotary means, driven in timed relationship with the rotation of the blower nozzle or multi-jet jet tube, having a plurality of spaced actuating means corresponding in inter-spacing to one or a number of complete blowing cycles of the blower and control means, adapted to be operated by any one of said actuating means, for causing the master control box to terminate the operation of the sootblower and to initiate operation of the next sootblower in sequence.

2. A sootblower as claimed in Claim 1, wherein the actuating means comprise pins or posts removably mounted on said rotary means such that removal of selected ones of the pins or posts permits two or more blowing cycles to take place successively before the next sootblower is brought into operation.

3. A sootblower as claimed in Claim 1 or 2, wherein the control means comprises a micro-switch, the operating arm of which is adapted to be engaged by said actuating means.

4. A sootblower as claimed in any one of Claims 1 to 3, wherein the blower nozzle or multi-jet jet tube is rotated by a shaft having a gearwheel mounted thereon driven by a gearwheel train from an electric motor.

5. A retractable sootblower as claimed in Claim 4, wherein reversal of the electric motor is effected by driving means comprising, an endless chain having spaced abutment means thereon passing around a plurality of sprocket wheels one of which is mounted on said shaft, a toggle-action lever disposed so as to be engageable with and movable by said spaced abutment means according to the increment of said chain and linkage means operatively connecting the lever to a reversing switch so that movement of said lever between predetermined positions controls the reversal of the electric motor.

6. A retractable sootblower as claimed in Claim 5, wherein the actuating means are mounted on a drum which is subjected to a step-by-step incremental drive, each step being equal to the spacing between adjacent positions of the actuating means and effected by the oscillatory increment of said lever.

7. A retractable sootblower as claimed in Claim 6, wherein the incremental drive is obtained by a ratchet wheel driven by said oscillating lever and pawl means mounted on said drum, the arrangement being such that movement of the lever in one direction is ineffective to drive the drum whilst movement of the lever in the other direction causes engagement of the pawl means in the ratchet wheel to effect a one-step rotation of the drum.

8. A retractable sootblower as claimed in Claims 6 or 7, wherein the periphery of the drum is provided with a recess at each pin or post position and a spring-loaded ball is positioned to engage one of the recesses at each stepped rotation of the drum.

9. A non-retractable sootblower as claimed in Claim 4, wherein the actuating means are mounted on a gearwheel driven by a further gearwheel train from said shaft.

10. A retractable sootblower substantially as described with reference to Figures 1 to 3 of the accompanying drawings.

11. A non-retractable sootblower substantially as described with reference to Figures 4 and 5 of the accompanying drawings.

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Chartered Patent Agents,
Agents for the Applicants.

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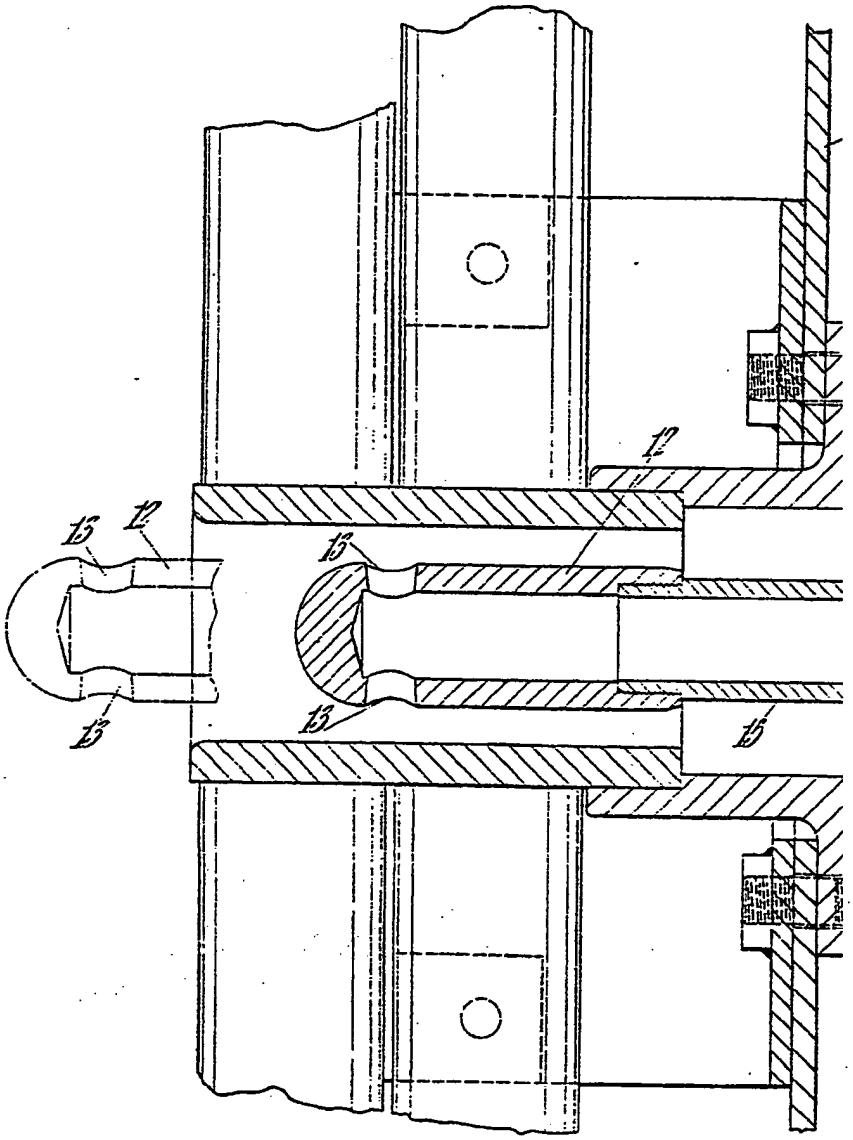

921392 COMPLETE SPECIFICATION

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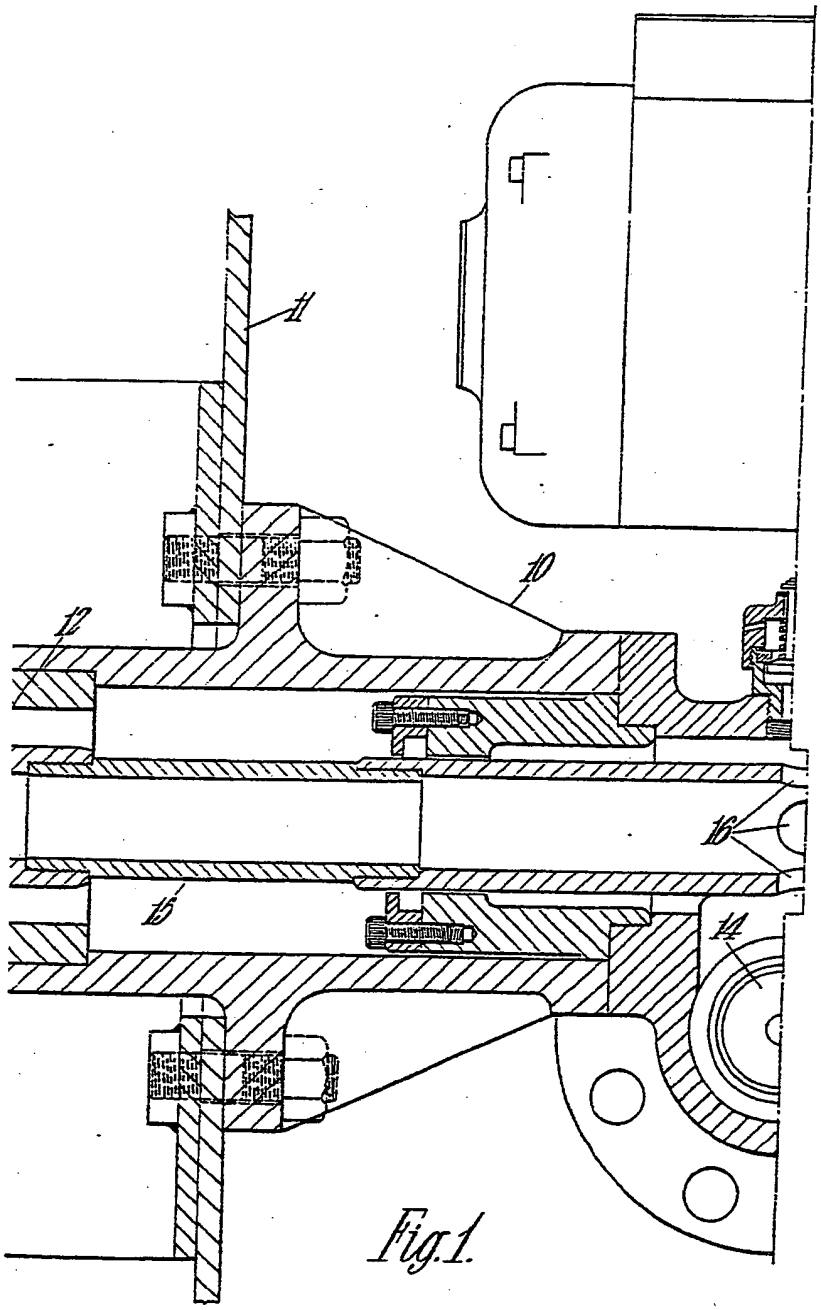

Fig.1.

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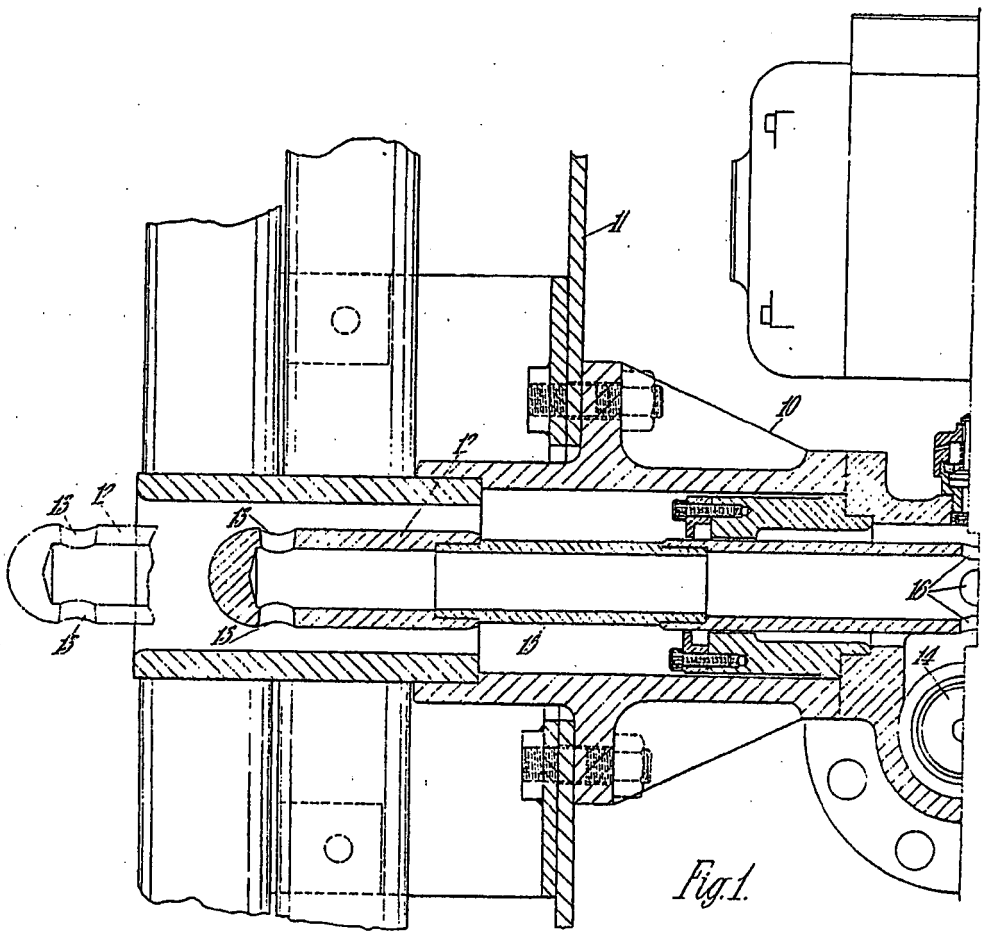

Fig.1.

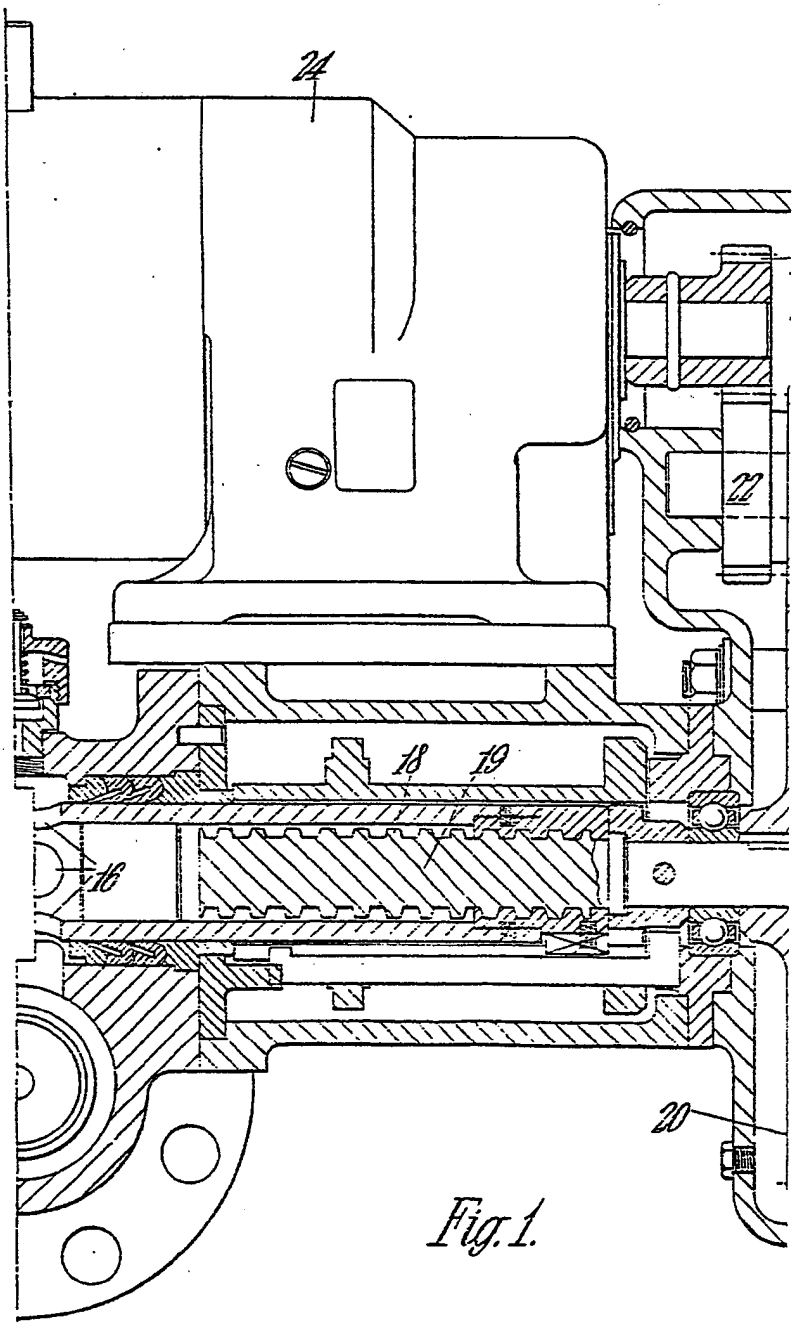

Fig. 1.

921392 COMPLETE SPECIFICATION

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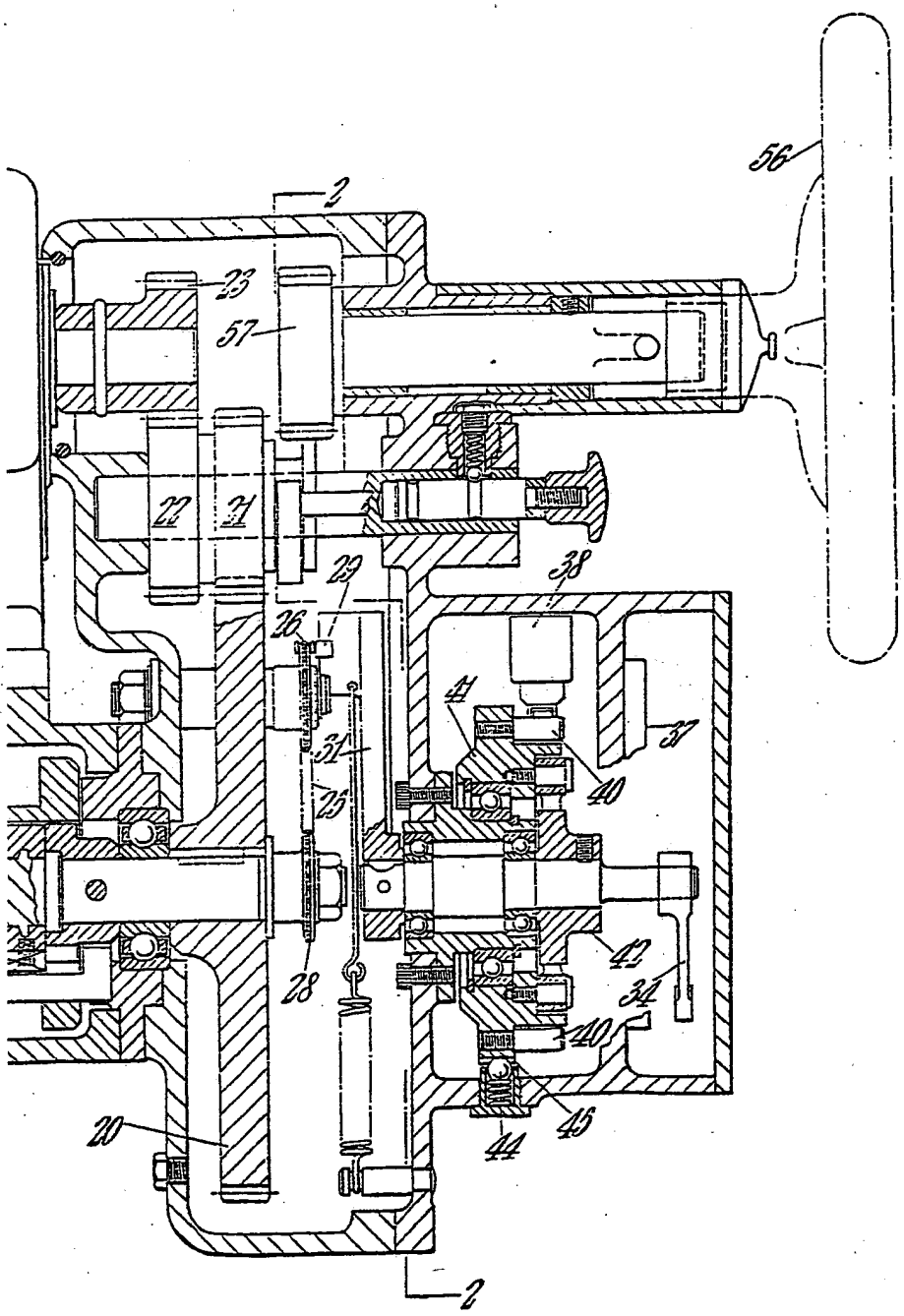

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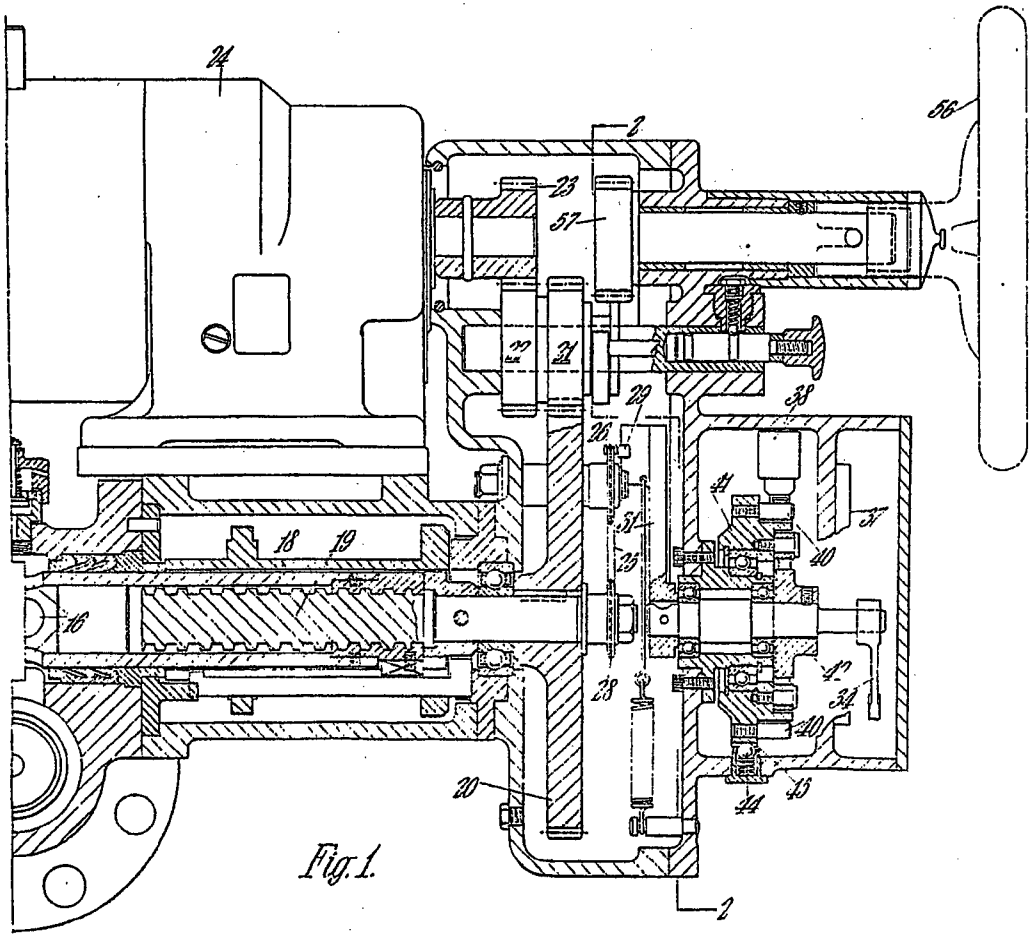

Fig. 1.

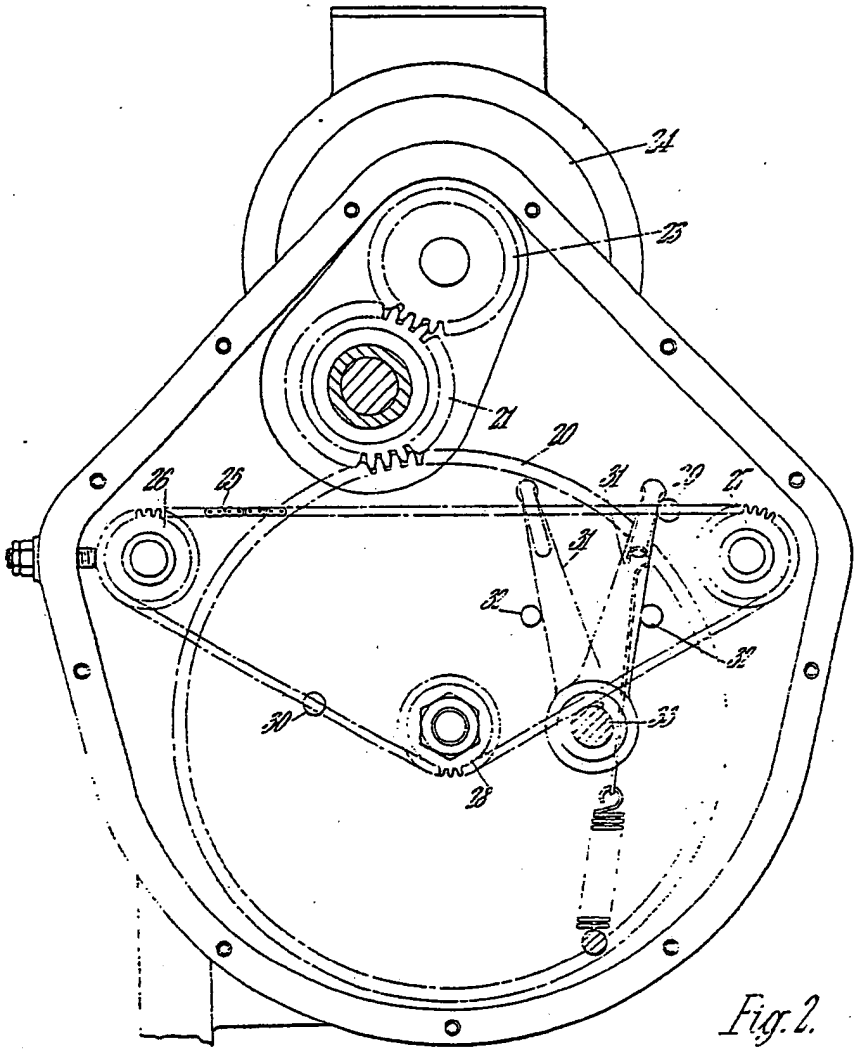

Fig. 2.

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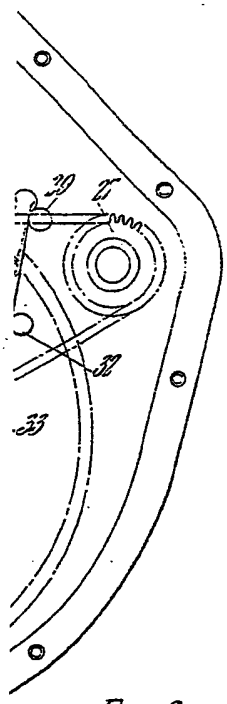

Fig. 2.

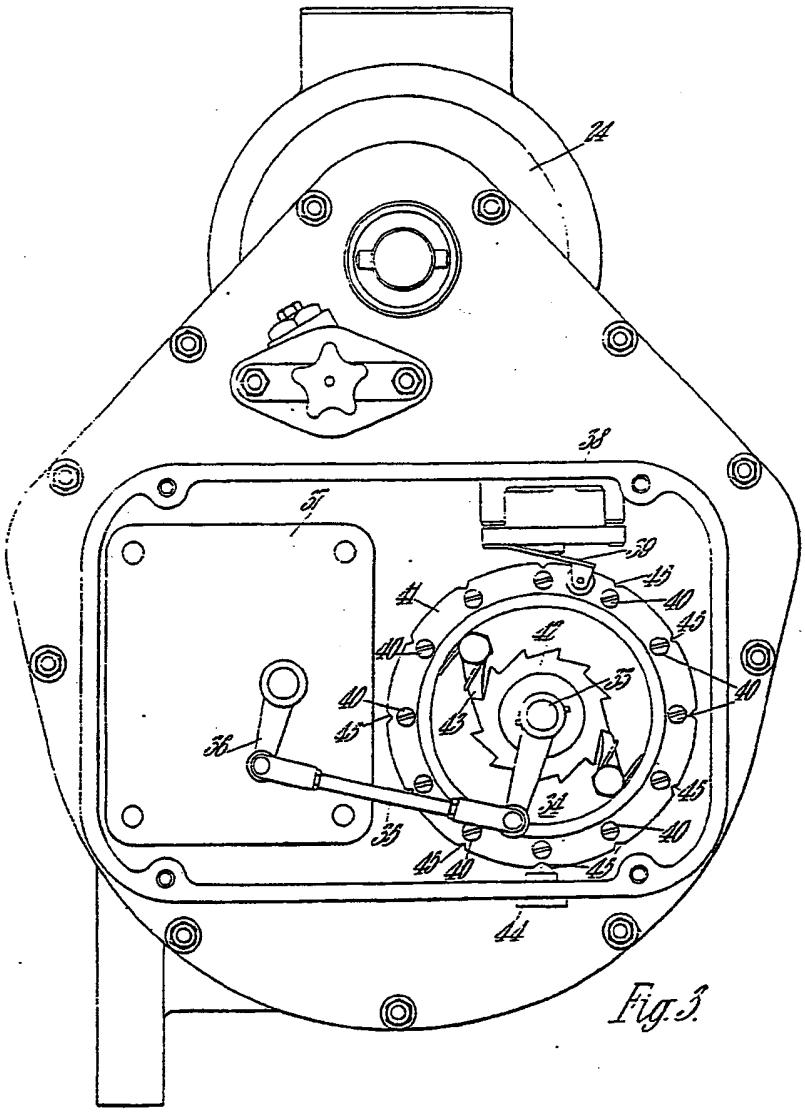

Fig. 3.

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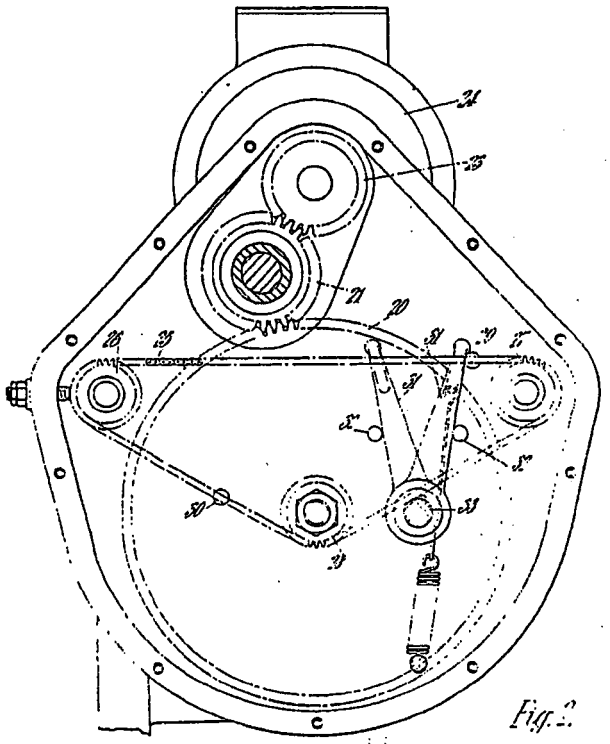

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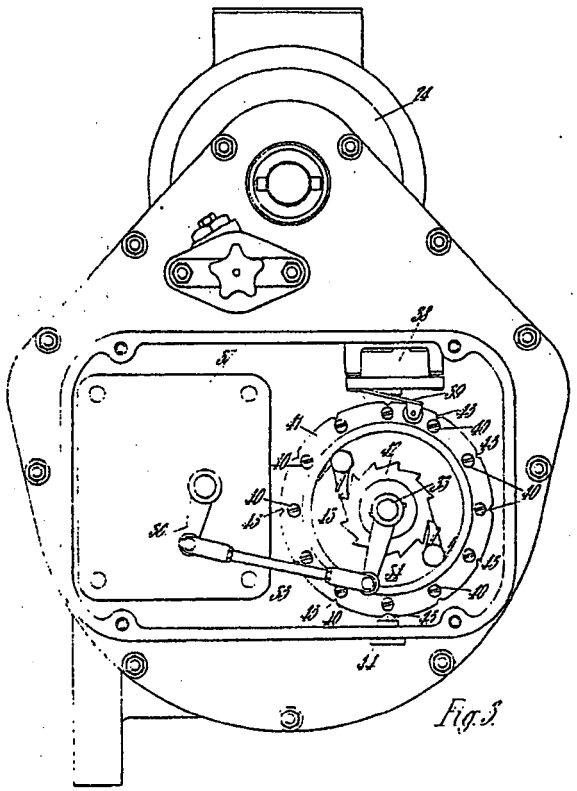

Fig. 3.

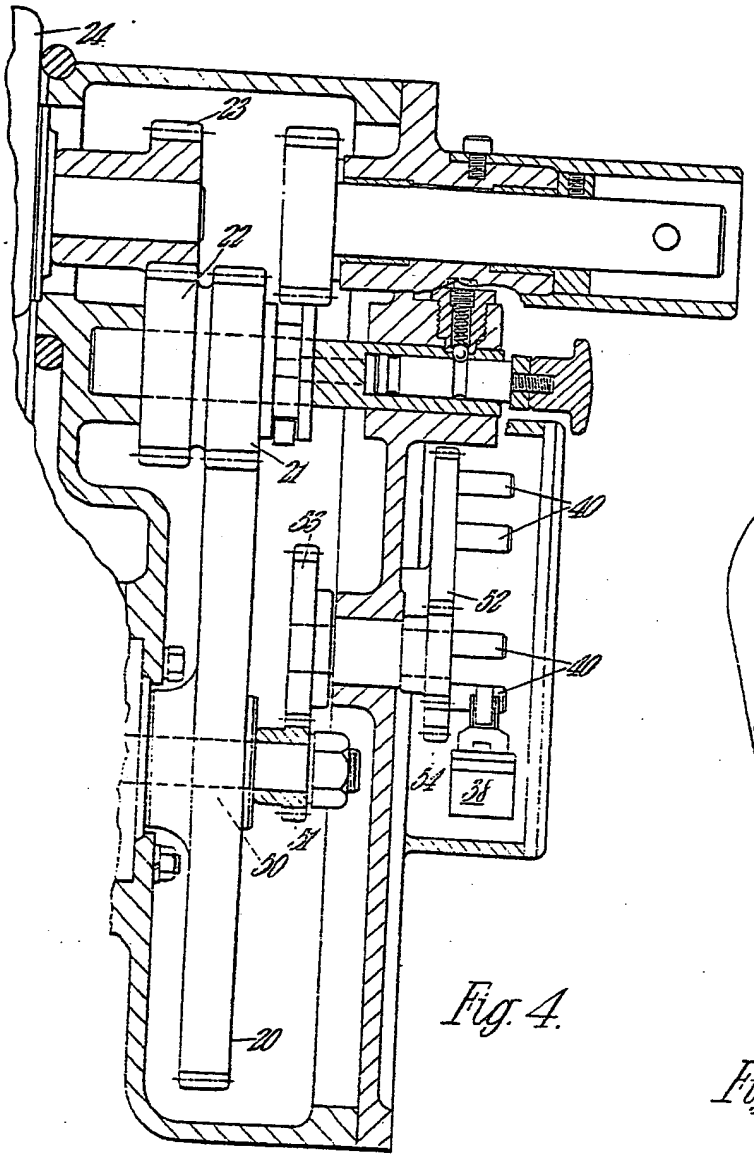

Fig. 4.

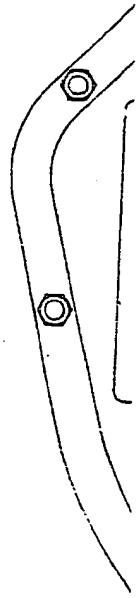

Fig. 5.

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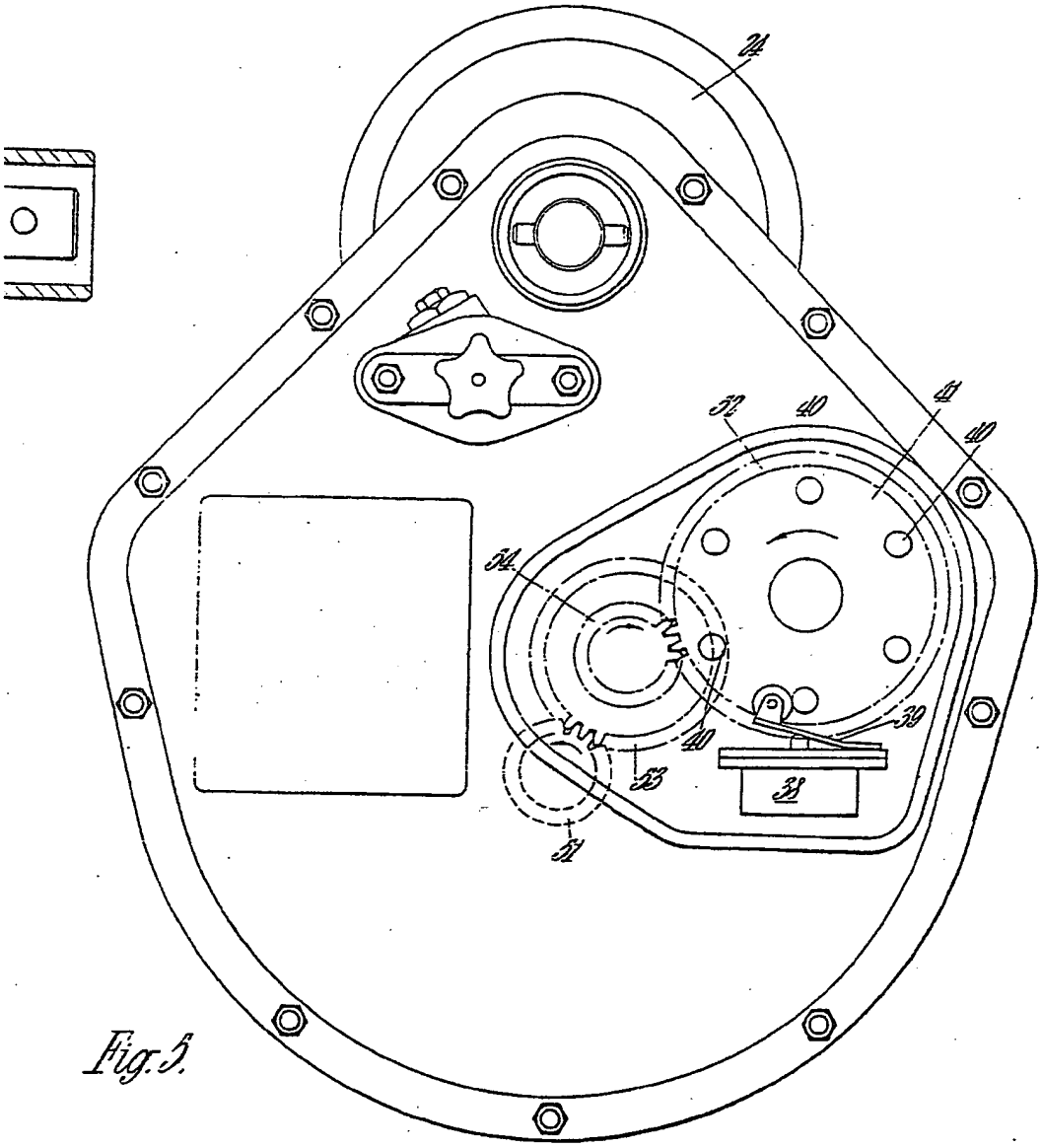

Fig. 5.

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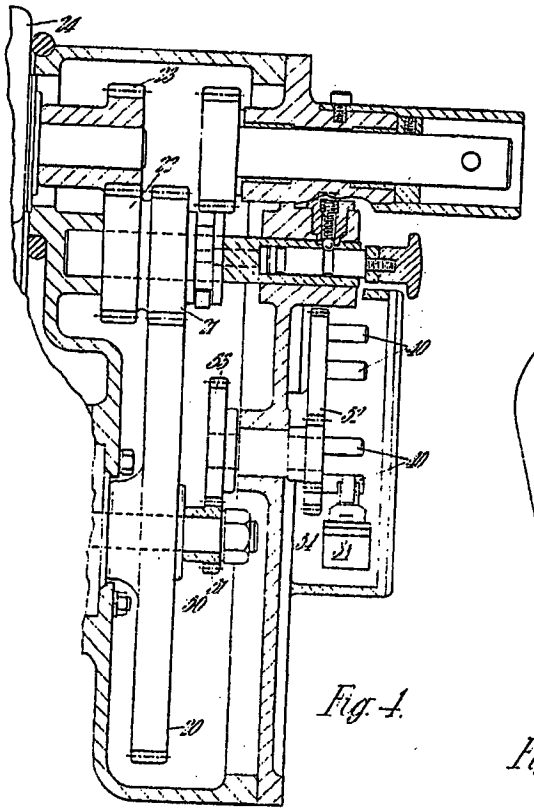

Fig. 4.

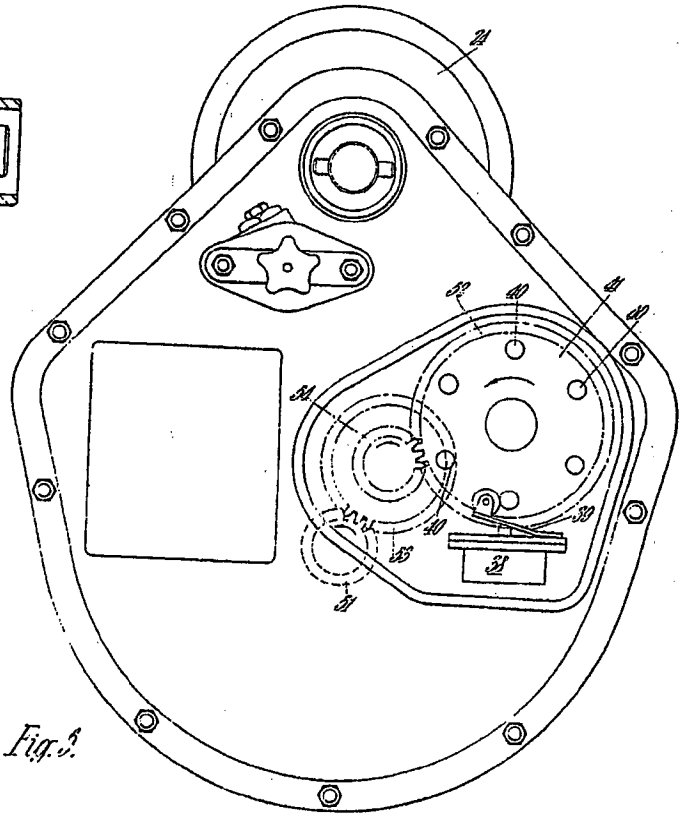

Fig. 5.